

Remarks

In view of the foregoing amendments and following remarks responsive to the Office Action dated October 6, 2006, Applicant respectfully requests favorable reconsideration of this application.

Applicant acknowledges with thanks the Office's indication that claims 4, 5, 9, 10, 14-17, 21-24, 29-31, 36-37, 41-45, and 49-52 are merely objected to as depending from a rejected base claim, but would be allowable if amended to independent form including the limitations of the base claim and any intervening claims.

Applicant also respectfully thanks the Office for the withdrawal of all previous rejections.

However, the Office has asserted new rejections with respect to claims 1-3, 6-8, 11-13, 18-20, 25-28, 33-35, 38-40, and 46-48. Specifically, the Office has asserted the following rejections:

1. Claims 1, 6, 11, 18, 26, and 33 are rejected under 35 U.S.C. § 103(a) as obvious over Hirano in view of Nam;
2. Claims 2, 3, 7, 8, 12, 13, 19, 20, 25, 27, 28, 34, and 35 are rejected as obvious over Hirano and Nam and further in view of Mansour & Gray;
3. Claims 38 and 46 are rejected as obvious over Hirano and Nam and further in view of Benesty; and
4. Claims 39, 40, 47, and 48 are rejected as obvious over Hirano, Nam and Benesty as applied to claims 38, 46, and further in view of Mansour & Gray.

The Office has asserted the new rejections responsive to Applicant's previous arguments that, contrary to the Office's earlier assertions, neither Hirano nor any of the

references referred to in Hirano teach a multi-channel frequency domain recursive least squares algorithm. Specifically, the new rejections are rather similar to the previous rejections except that the Office now concedes that Hirano does not teach a frequency domain RLS algorithm. However, the Office has cited Nam as teaching a frequency domain block RLS adaptive algorithm that is useful for identification of a nonlinear system and that uses an adaptive filtering process for nonlinear distortion in a communication system.

The Office asserted that it would have been obvious to modify the multi-channel echo canceling apparatus of Hirano with the more powerful frequency domain block RLS adaptive algorithm of Nam in adaptive filtering transfer function processing in order to obtain more accurate statistically meaningful results.

Applicant respectfully traverses the rejections. All of the rejections are based on the assertion that Nam teaches a frequency domain RLS algorithm. However, this does not address the claimed invention, which is a frequency domain recursive least squares (RLS) algorithm for correcting for echo responses in a stereo or other multi-channel environment. As far as Applicants are aware, they are the first to develop a technique meeting these three criteria, i.e., (1) frequency domain, (2) RLS, and (3) multi-channel.

While Nam discloses a frequency domain block RLS adaptive algorithm, it is for a single channel system, not a multi-channel system as claimed in all claims in the application. Nam is somewhat similar to the Mansour and Gray reference discussed in Applicant's response to the Office Action of August 24, 2005. Specifically, like Mansour & Gray, Nam discloses a single channel algorithm. The difference between a single

channel frequency domain RLS algorithm and a multi-channel frequency domain RLS algorithm certainly is not a trivial or obvious advancement.

In fact, the Nam reference does not teach anything that is not already taught in references cited and discussed in the specification of the present application. Specifically, see page 14, lines 15-24 of the present specification, which specifically discusses the single channel frequency domain RLS algorithms developed, not only by Mansour and Gray, but also by Ferrara. Nam is just another such single channel frequency domain RLS algorithm.

Thus, the prior art of record does not disclose a multi-channel frequency domain RLS algorithm.

Each of the independent claims recites (1) multi-channel, (2) RLS, and (3) frequency domain and therefore distinguishes over the prior art of record.

Specifically, the preamble of claim 1 recites "A method of adaptively filtering a signal transmitted over a channel, said signal containing an input signal and multiple echo responses, said multiple echo responses to be adaptively filtered". Furthermore, the body of the claim recites "generating an estimate of an echo response corresponding to each of said multiple echo responses", "generating a sum of said estimates", "generating an error signal representing the difference between said signal and said sum of said estimates" and "wherein said estimates are generated using a frequency domain recursive least squares algorithm".

The preamble of independent claim 6 recites "A method for transmitting an input signal over a channel in a multiple channel communication apparatus where said input signal generates multiple echo responses and results in an output signal, wherein said

multiple echo responses are adaptively filtered". Furthermore, the body of claim 6 recites "transmitting said signal over a channel, wherein said input signal generates at least first and second echo responses", "generating an estimate of an echo response corresponding to each of said first and second echo responses", "generating a sum of said estimates", "generating an error signal representing the difference between said signal and sum of said estimates", and "wherein said estimate are generated using a frequency domain recursive least squares algorithm".

The preamble of independent claim 11 recites "An apparatus for transmitting an input signal over a channel in a multiple channel communication apparatus". The body of claim 11 further recites "a transmitter for generating an input data signal for transmission via a communication channel, wherein said input data signal generates multiple echo responses on said channel and results in an output data signal, wherein said multiple echo responses are to be adaptively filtered", "an adaptive filter circuit for generating an estimate of an echo response corresponding to each of said multiple echo responses", "a subtracter circuit for generating an error signal representing the difference between said output data signal and a sum of said estimates", and "wherein said estimates are generated using a frequency domain recursive least squares algorithm".

The preamble of independent claim 18 recites "A method of multi-channel communication between at least first and second locations". The body of claim 18 further recites "transmitting multiple channels of information upstream from said first location to said second location", "generating an estimate of an echo response corresponding to a distortion paths at said second location coupled between each of

said multiple upstream channels and said downstream channel", "generating an error signal representing the difference between a desired signal on said downstream channel and a sum of said estimates and transmitting said error signal to said first location", and "wherein said estimates are generated using a frequency domain recursive least squares algorithm".

The preamble of independent claim 26 recites "A method of canceling distortion in a communication system having multiple upstream transmission channels". The body of claim 26 further recites "developing an estimated echo response corresponding to each of said multiple upstream channels that models an interference path at said second location from said corresponding upstream channel to said downstream channel", "convolving each of said estimated echo responses with a signal on the corresponding one of said upstream channels to generate an estimate corresponding to each of said upstream channels", summing each of said estimates", and "wherein said estimate is generated using a frequency domain recursive least squares algorithm".

The preamble of independent claim 33 recites "A method of canceling acoustic echo in a communication system having multiple upstream transmission channels". The body of claim 33 further recites ". The body of claim 33 further recites "developing an estimated echo response corresponding to each of said multiple upstream channels that models an echo path at said second location from said corresponding upstream channel to said downstream channel", "convolving each of said estimated echo responses with a signal on the corresponding one of said upstream channels to generate an estimate corresponding to each of said upstream channels", "summing each of said estimates",

and "wherein said estimates are generated using a frequency domain recursive least squares algorithm".

The preamble of independent claim 38 recites "A multi-channel teleconferencing apparatus". The body of claim 38 further recites ". The body of claim 38 further recites "at least first and second upstream electrical paths", and "a finite impulse response filter coupled between said upstream paths and said downstream path for generating an estimate of an echo response corresponding to echo paths at said second location coupled between said at least first and second upstream channels and said downstream channel, said estimate being generated using a frequency domain recursive least squares algorithm".

Finally, the preamble of independent claim 46 recites "An apparatus for performing echo cancellation in a multi-channel teleconferencing system" and "at least first and second upstream electrical paths". The body of claim 46 further recites ". The body of claim 46 further recites, "at least one non-linear transformation module for coupling within each of one or more of said upstream paths", and "a finite impulse response filter for coupling between said upstream paths and said downstream path for generating an estimate of an echo response corresponding to echo paths at said second location coupled between each of said multiple upstream channels and said downstream channel in which said estimate is generated using a frequency domain recursive least squares algorithm".

Accordingly, all of the prior art rejections necessarily fail for at least the reason that Nam does not teach a multi-channel frequency domain RLS algorithm.

In view of the foregoing amendments and remarks, Applicants respectfully submit that this application is now in condition for allowance. Applicants respectfully request the Examiner to issue a Notice of Allowance at the earliest possible date. The Examiner is invited to contact Applicants' undersigned counsel by telephone call in order to further the prosecution of this case in any way.

Respectfully submitted,

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/Theodore Naccarella/
Theodore Naccarella
Registration No. 33,023
Synnestvedt & Lechner, LLP
2600 Aramark Tower
1101 Market Street
Philadelphia, PA 19107
Telephone: (215) 923-4466
Facsimile: (215) 923-2189

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